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PENSOFT

Distribution extension and a new state record for *Amphisbaena mertensi* Strauch, 1881 (Squamata, Amphisbaenidae) in central Brazil

Bruno Alessandro Augusto Peña Corrêa[1, 2], Afonso Santiago de Oliveira Meneses[1]

1 Universidade de Brasília, Departamento de Engenharia Florestal, Laboratório de Fauna e Unidades de Conservação, L3 norte, Brasília, DF, CEP 70919-970, Brazil, **2** Universidade de Brasília, Departamento de Ciências Fisiológicas, Laboratório de Anatomia Comparada de Vertebrados, L3 norte, Brasília, DF, CEP 70919-970, Brazil.
Corresponding author: Bruno Alessandro Augusto Peña Corrêa, brunobio.unb@gmail.com

Abstract
We updated the distribution of *Amphisbaena mertensi* to northeastern central Brazil based on the finding of a specimen in an urban area in the Cerrado. This species had already been recorded in south-central Brazil, Paraguay, and Argentina. Our new record is 300 km away from the nearest point, Araguari, in the north of the State of Minas Gerais, Brazil. We included a distribution map for the species in South America, and a list of the amphisbaenas species found in Distrito Federal and discuss the conservation of this group.

Keywords
Cerrado, Distrito Federal, Squamata, Neotropical, South America, worm lizard.

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Introduction

Amphisbaenians are squamate reptiles which can be identified by the presence of segmented scales and a serpentine body (Vitt and Caldwell 2014). They have fossorial habits and occur in Africa and Central and South America (Costa and Garcia 2019). Currently, about 200 species are recognized, grouped into six families: Bipedidae, Blanidae, Cadeidae, Rhineuridae, Trogonophidae (Vitt and Caldwell 2014), and Amphisbaenidae. The Amphisbaenidae is the most diverse family and comprises 176 species in 12 genera (Uetz 2019). This family is also the most widely distributed, occurring in Central and South America and Africa (Costa and Garcia 2019). In Brazil, 73 species are recognized, and 34 of them are found in the Cerrado biome (Colli et al. 2002; Pinna et al. 2010; Nogueira et al. 2011; Gomes and Maciel 2012; Ribeiro et al. 2016).

There are 131 species in the genus *Amphisbaena* Linnaeus, 1758 (Costa and Garcia 2019; Uetz 2019). This group is known for its confusing taxonomy (Mott and Vieites 2009; Costa and Garcia 2019), and despite varied approaches, such as molecular phylogeny, the monophyly of several clades within this family is still uncertain (Mott and Vieites 2009; Ribeiro et al. 2011, 2018; Costa and Garcia 2019).

Amphisbaena mertensi (Strauch 1881) is a medium-sized, oviparous species which occurs throughout central and southern Brazil (Fig. 1) (Gans 1966; Andrade et al. 2006; Ribeiro et al. 2007). It feeds mainly on ants and termites, but also on other invertebrates (Neto and Abe 1993; Pramuk and Alamillo 2003). It has been found in seven Brazilian states: southern Mato Grosso and Mato Grosso do Sul, eastern Paraná, Santa Catarina, São

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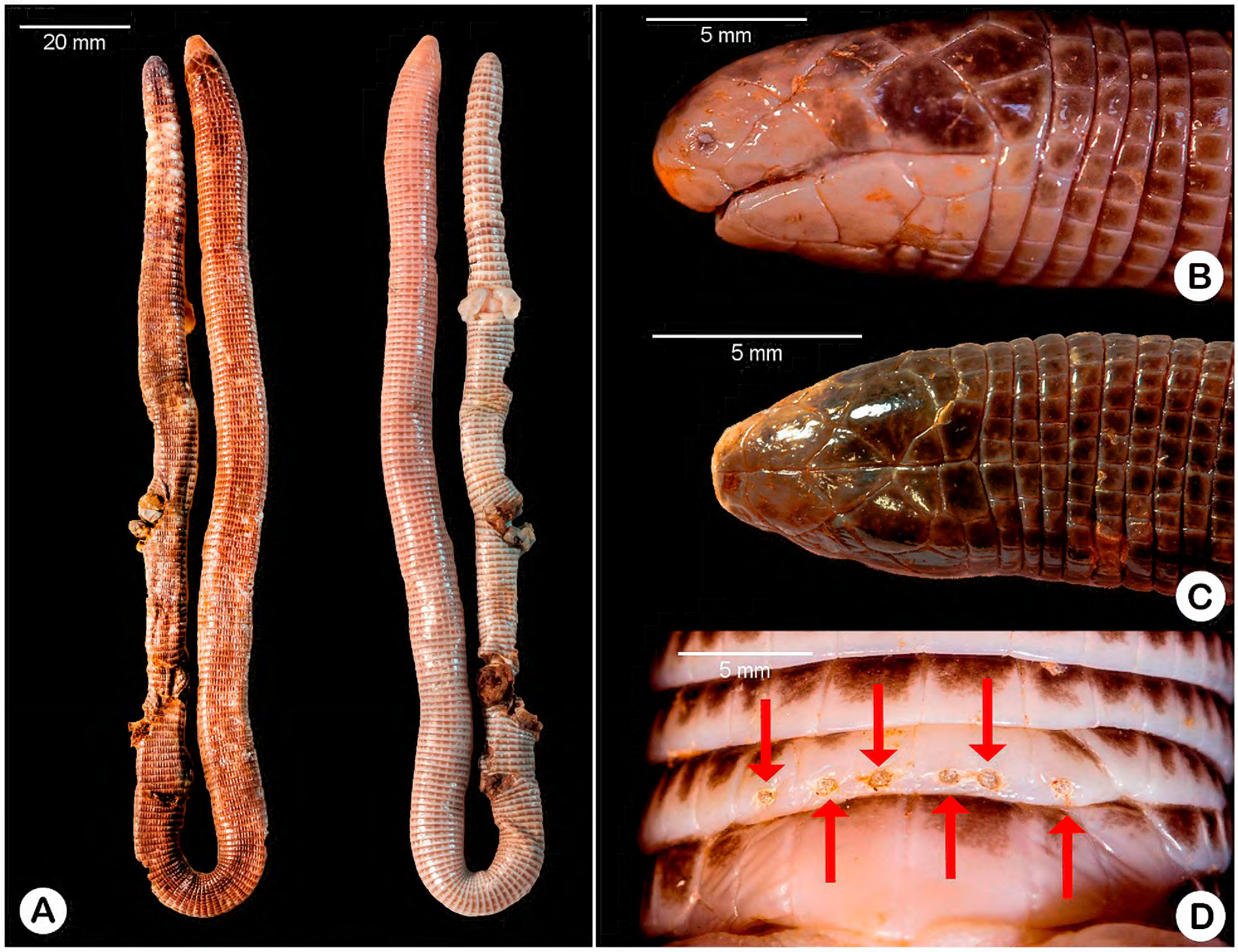

Figure 1. *Amphisbaena mertensi,* LACV-3592. **A.** Dorsal view. **B.** Side view of the head. **C.** Dorsal view of the head. **D.** Cloacal pores indicated by red arrows.

Paulo, southwestern Minas Gerais, and the state border between Goiás and Mato Grosso. It also occurs in Paraguay and Argentina (Gans 1966; Ribeiro et al. 2007; Silveira et al. 2012). Here, we present a new occurrence of this species in the Cerrado and a distribution map. We also summarize the *Amphisbaena* species of the Distrito Federal and discuss the conservation of this genus.

Methods

During a field expedition in an urban area, we found a dead specimen of an amphisbaenian. It was collected, fixed in 10% formalin, and later stored in 70% ethanol. This specimen was deposited in the Coleção do Laboratório de Anatomia Comparada de Vertebrados (LACV) of the Universidade de Brasília, Brasília, Brazil (Fig. 1).

An updated occurrence map of *A. mertensi* in South America, based on a comprehensive search in scientific literature, was generated with the software QGIS v. 3.8. We sought the combination of terms "*Amphisbaena mertensi*", "distribution", "occurrence", "Neotropical", "Brazil", and "South America". Furthermore, we investigated what species of the genus *Amphisbaena* occur in the Distrito Federal (Table 1), seeking the terms "Amphisbaenidae Distrito Federal", "*Amphisbaena* Distrito Federal", "Brasília" and "reptiles Distrito Federal" in the scientific literature.

Results

Amphisbaena mertensi Strauch 1881

New record. BRAZIL • 1 ♂, 256 mm; Distrito Federal,

Table 1. Morphological comparison of *Amphisbaena* species in Distrito Federal (SL = supralabials, IL = infralabials, MBS = midbody segments).

Species	Preanal pores	Body annuli	Tail annuli	SL	IL	Dorsal MBS	Ventral MBS	Reference
A. alba	4–10	198–248	13–21	3–4	3/3	30–42	35–46	Vanzolini 2002
A. anaemariae	2	156–170	18–20	4/4	4/4	14–16	14–16	Vanzolini 1997
A. mertensi	6–8	210–250	25–29	3/3	3/3	14–25	16–25	Gans 1966
A. talisiae	4	205–234	17–29	3/3	3/3	10–14	14–18	Costa et al. 2019
A. vermicularis	4–6	211–246	23–34	4/4	3/3	18–26	18–26	Hoogmoed and Ávila-Pires 1991

Brasília, Condomínio Residencial Mônaco; 15°56.685S, 047°48.869′W; alt. 1093 m a.s.l; 3 June 2019; Bruno Alessandro Augusto Peña Corrêa leg.; LACV 3592.

Identification. The species was identified with aid of published works by Gans (1966), Vanzolini (2002), and Ribeiro et al. (2007). Professor Wilian Vaz-Silva, Pontifical Catholic University of Goiás, confirmed our identification. The specimen presented six preanal pores, 231 body annuli, 27 tail annuli, 25 dorsal midbody segments, 17 ventral midbody segments, 3/3 supralabials, and 3/3 infralabials. The specimen has a snout–vent length of 256 mm, a tail length of 44 mm, and a head length of 7 mm. Although it may share the same number of preanal pores with *Amphisbaena fuliginosa* Linnaeus, 1758, *A. stejnegeri* Ruthven, 1922, *A. ignatiana* Vanzolini, 1991, and *A. vermicularis* Wagler, 1824, the specimen can be distinguished by the number of annuli on the body and tail: *A. fuliginosa* has 190–220 body annuli and 23–30 tail annuli; *A. stejnegeri* has 243–247 body annuli; and *A. ignatiana* has 255–263 body annuli and 32–36 tail annuli (Table 1). Our specimen of *A. mertensi* also differs by the number of supralabials: 3/3 in *A. mertensi* vs 4/4 in *A. vermicularis* (Ribeiro et al. 2007) (Fig.1.).

Distribution. We found 57 records of *A. mertensi* in Brazil, Paraguay, and Argentina. Most of the occurrences in Brazil are from the state of São Paulo (26 records), and there are a few from the Paraná (eight records) and Minas Gerais (five records) and only one record each in Mato Grosso do Sul, Mato Grosso, and Goiás, apart from our new Distrito Federal record. In Paraguay, distribution records range from the south-central part of the country to the capital, Asuncion. In Argentina, the occurrences are concentrated in the northeastern part of that country (Fig. 2).

Discussion

Amphisbaena mertensi is generally associated with open habitat in the Cerrado biome or in ecotones with the Atlantic Forest (Marques et al. 2009). Our record is the most northern of occurrence of this species and is 300 km from the nearest previously known occurrence, which is in the city of Araguari, Minas Gerais. The Distrito Federal specimen represented the first time that this species has been found in an urban area, which demonstrates that this species can occur in anthropized environments (Moraes and Recchia 2011; Ribeiro et al. 2007). More studies are needed to investigate how urban expansion and the suppression of natural areas affect the ecology of reptiles, such as *A.mertensi* (Ribeiro et al. 2007; Moraes and Recchia 2011).

This is the fifth species of amphisbaenas recorded in the Distrito Federal. The other four species are *Amphis-*

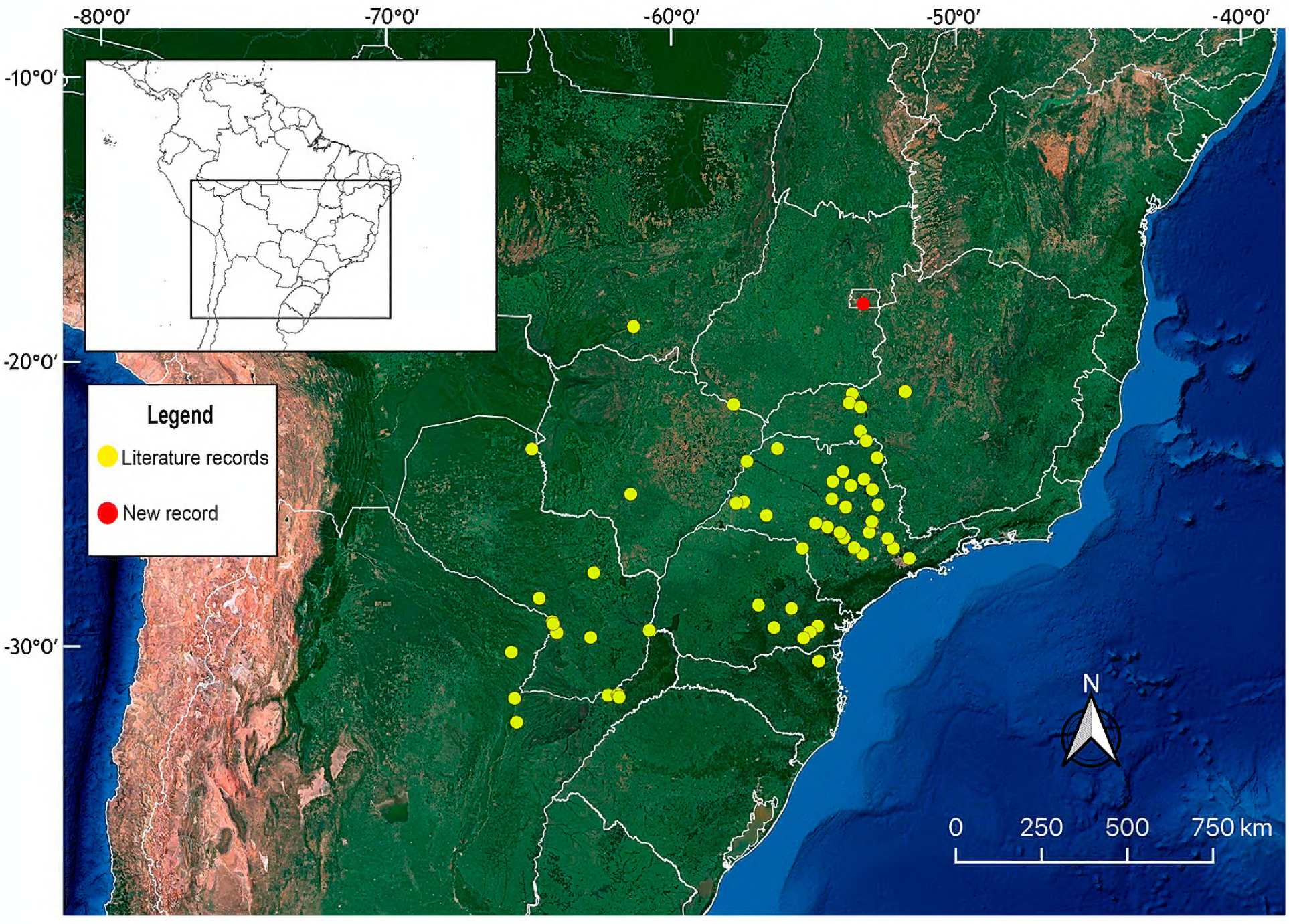

Figure 2. Geographical distribution of *Amphisbaena mertensi* in South America. Yellow circles = literature records; red circle = new record in Brasília, Distrito Federal, Brazil (see Appendix, Table A1 for localities and sources of data).

baena alba Linnaeus, 1758; *Amphisbaena anaemariae* Vanzolini, 1997; *Amphisbaena talisiae* Vanzolini, 1995; and *Amphisbaena vermicularis* (Colli and Zamboni 1999; Nogueira 2001; Costa et al. 2019) (Table 1). Some species are more common and widely distributed, such as *A. alba*, *A. mertensi*, and *A. talisiae* (Gans and Amdur 1966; Colli and Zamboni 1999; Ribeiro et al. 2007; Costa et al. 2019), and the other species, *A. anaemariae* and *A. vermicularis*, are uncommon (Gans 2005; Santos et al. 2014). Therefore, rarity of encounters due to fossorial habits and difficulty in identification contribute to the underrecording of these species (Gans 1966; Costa and Garcia 2019).

Only 103 of the world's amphisbaenian species have been evaluated by the IUCN (2019). Of those, 65 species are of Least Concern (63%) and 14 species are Threatened (13.6%); 24 species are Data Deficient (23%). *Amphisbaena mertensi*, *A. alba*, and *A. vermicularis* are currently categorized as Least Concern (IUCN 2019; Ministério do Meio Ambiente 2018). *Amphisbaena talisiae* and *A. anaemariae* were not evaluated by the IUCN (2019), the Ministério do Meio Ambiente (2018) found these species to be Data Deficient and Least Concern, respectively.

The lack of knowledge about the ecology and distribution of species is a challenge for conservation, and this favors the increase of threats to species, such as habitat loss from agricultural and urban expansion (Nogueira et al. 2011). With our new record, the distribution of *A. mertensi* is expanded to the center of the Cerrado.

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Authors' Contributions

BAAPC wrote the manuscript, collected field data, and prepared Table 1; ASOM wrote the manuscript, produced the map, and prepared Table 2. Both authors reviewed and approved the final manuscript.

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Appendix

Table A1. Locality records of *Amphisbaena mertensi* from South America, derived from literature records and from the present study.

Locality	Country	Latitude	Longitude	Reference
Aporé, Goiás	Brazil	−18.9653	−051.9264	Ribeiro et al. 2007
Patos de Minas, Minas Gerais	Brazil	−18.5789	−046.5181	Silveira et al. 2012
Araguari, Minas Gerais	Brazil	−18.6472	−048.1872	Silveira et al. 2012
Uberlândia, Minas Gerais	Brazil	−18.9186	−048.2772	Silveira et al. 2012
Indianópolis, Minas Gerais	Brazil	−19.0386	−047.9169	Silveira et al. 2012
Uberaba, Minas Gerais	Brazil	−19.7483	−047.9319	Silveira et al. 2012
Jundiaí, São Paulo	Brazil	−23.1864	−046.8842	Gans 1966
Itaim Paulista, São Paulo	Brazil	−23.4817	−046.3867	Gans 1966
Campinas, São Paulo	Brazil	−22.9056	−047.0608	Gans 1966
Piracicaba, São Paulo	Brazil	−22.7253	−047.6492	Gans 1966
Tatuí, São Paulo	Brazil	−23.3556	−047.8569	Gans 1966
Boa Esperança do Sul, São Paulo	Brazil	−21.9925	−048.3908	Gans 1966
Botucatu, São Paulo	Brazil	−22.8858	−048.445	Gans 1966
São Manuel, São Paulo	Brazil	−22.7311	−048.5706	Gans 1966
Borebi, São Paulo	Brazil	−22.5694	−048.9711	Gans 1966
Cabrália Paulista, São Paulo	Brazil	−22.4556	−049.3375	Gans 1966
Cachoeira de Emas, São Paulo	Brazil	−21.9281	−047.3686	Gans 1966
Rio Claro, São Paulo	Brazil	−22.4114	−047.5614	Gans 1966
São Simão, São Paulo	Brazil	−21.4792	−047.5508	Gans 1966
Ibitinga, São Paulo	Brazil	−21.7578	−048.8289	Gans 1966
Ribeirão Preto, São Paulo	Brazil	−21.1775	−047.8103	Gans 1966
Porangaba, São Paulo	Brazil	−23.1758	−048.125	Gans 1966
Bebedouro, São Paulo	Brazil	−20.9494	−048.4792	Gans 1966
Franca, São Paulo	Brazil	−20.5386	−047.4008	Gans 1966
Igarapava, São Paulo	Brazil	−20.0383	−047.7469	Gans 1966
Guariba, São Paulo	Brazil	−21.3600	−048.2283	Gans 1966
Santa Adélia, São Paulo	Brazil	−21.2428	−048.8042	Gans 1966
Jales, São Paulo	Brazil	−20.2689	−050.5458	Gans 1966
Itapura, São Paulo	Brazil	−20.6461	−051.5089	Gans 1966
Rancharia, São Paulo	Brazil	−22.2292	−050.8931	Gans 1966
Santo Anastácio, São Paulo	Brazil	−21.8383	−051.6103	Gans 1966
Presidente Venceslau, São Paulo	Brazil	−21.8761	−051.8439	Gans 1966
Ribeirão Claro, Paraná	Brazil	−23.1942	−049.7581	Gans 1966
Carambeí, Paraná	Brazil	−24.9178	−050.0972	Gans 1966
Curitiba, Paraná	Brazil	−25.4278	−049.2731	Gans 1966
Guajuvira, Paraná	Brazil	−25.5975	−049.5164	Gans 1966
Lapa, Paraná	Brazil	−25.7697	−049.7158	Gans 1966
Iratí, Paraná	Brazil	−25.4672	−050.6511	Gans 1966
Foz do Iguaçu, Paraná	Brazil	−25.5478	−054.5881	Gans 1966
Tereza Cristina, Paraná	Brazil	−24.8294	−051.1406	Gans 1966
Corupá, Santa Catarina	Brazil	−26.4253	−049.2431	Gans 1966
Maracajú, Mato Grosso do Sul	Brazil	−21.6144	−055.1683	Gans 1966
Col. Santa Tereza, Mato Grosso	Brazil	−16.6188	−055.0773	Gans 1966
Brasília, Distrito Federal	Brazil	−15.9419	−047.8147	This study
Posadas, Misiones	Argentina	−27.3833	−055.8833	Montero 1996
Cerro Santa Ana, Misiones	Argentina	−27.3666	−055.5666	Montero 1996
San Ignacio, Misiones	Argentina	−27.4333	−055.5333	Montero 1996
Capital, Corrientes	Argentina	−27.4666	−058.8333	Montero 1996
San Lorenzo, Corrientes	Argentina	−28.1333	−058.7666	Montero 1996
Reserva Ecológica El Balgual, Formosa	Argentina	−26.1666	−058.9333	Montero 1996
Asunción	Paraguay	−25.3006	−057.6359	Montero & Terol 1999
Col. Nueva Italia, Asunción	Paraguay	−25.6166	−057.5000	Montero & Terol 1999
Parque Nacional Cerro Corá	Paraguay	−20.2833	−058.2833	Montero & Terol 1999
Lago Ypoá, Tarumá	Paraguay	−24.6333	−058.0500	Montero & Terol 1999
Estância Carumbé, San Pedro	Paraguay	−23.9000	−056.3333	Montero & Terol 1999
Col. Elisa, Asunción	Paraguay	−25.3666	−057.6166	Montero & Terol 1999
Villarica	Paraguay	−25.7500	−056.4333	Montero & Terol 1999